

Photoproduction of Vector Mesons Off Nuclei

P.-Y. Bertin, M. Kossov, B.M. Priedom, Spokespersons

This experiment is designed to measure the properties of vector mesons in nuclear matter. At high baryon density the masses of vector mesons are predicted to change due to chiral symmetry restoration. The predicted downward shift of the vector meson masses is 10 to 20%. The photoproduction of vector mesons near threshold can be used to measure the masses and widths of vector mesons embedded in nuclear matter. It may also be possible to measure the mass shift for narrow vector mesons. Because of the long decay length $c\tau$, only a small fraction of these vector mesons will decay inside the nucleus. However, since the mass shift is predicted to be substantial relative to the natural width, these decays will be easier to separate from vector mesons decaying outside of the nucleus.

Detecting the leptonic decays of vector mesons is the only reliable way to measure the mass shift of vector mesons because the hadronic decay in nuclear matter is always disturbed by final state interactions. The small cross sections for incident photons and for secondary interactions of the outgoing electrons with nuclear matter makes this reaction the ideal probe for testing the properties of the dense central region of the nucleus without significant input and output distortions. We plan to measure the

$A(\gamma, e^+e^-)A'$ reactions by identifying the coincident electron pairs in the CLAS detector. Energy deposition in the electromagnetic calorimeter, the Cerenkov counter signal, and transverse momentum compensation define clear cuts for the separation of the e^+e^- events from the large hadronic background.

We plan to take data on four nuclear targets simultaneously: deuterium, carbon, iron and lead with a beam intensity of 5×10^7 tagged photons per second in the energy range 1.2 to 2.2 GeV ($E_0 = 2.4$ GeV). Setting the magnetic field of the CLAS detector to half its maximum value was found to be optimal for this photon energy range. Tagged photons are to be used to determine the kinematics of the reaction. In the off-line analysis, the e^+e^- mass spectra can be analyzed under different kinematical conditions. Specifically, coherent vector meson production can be suppressed by detecting the recoiling nucleon (proton or neutron).